FIG. 1

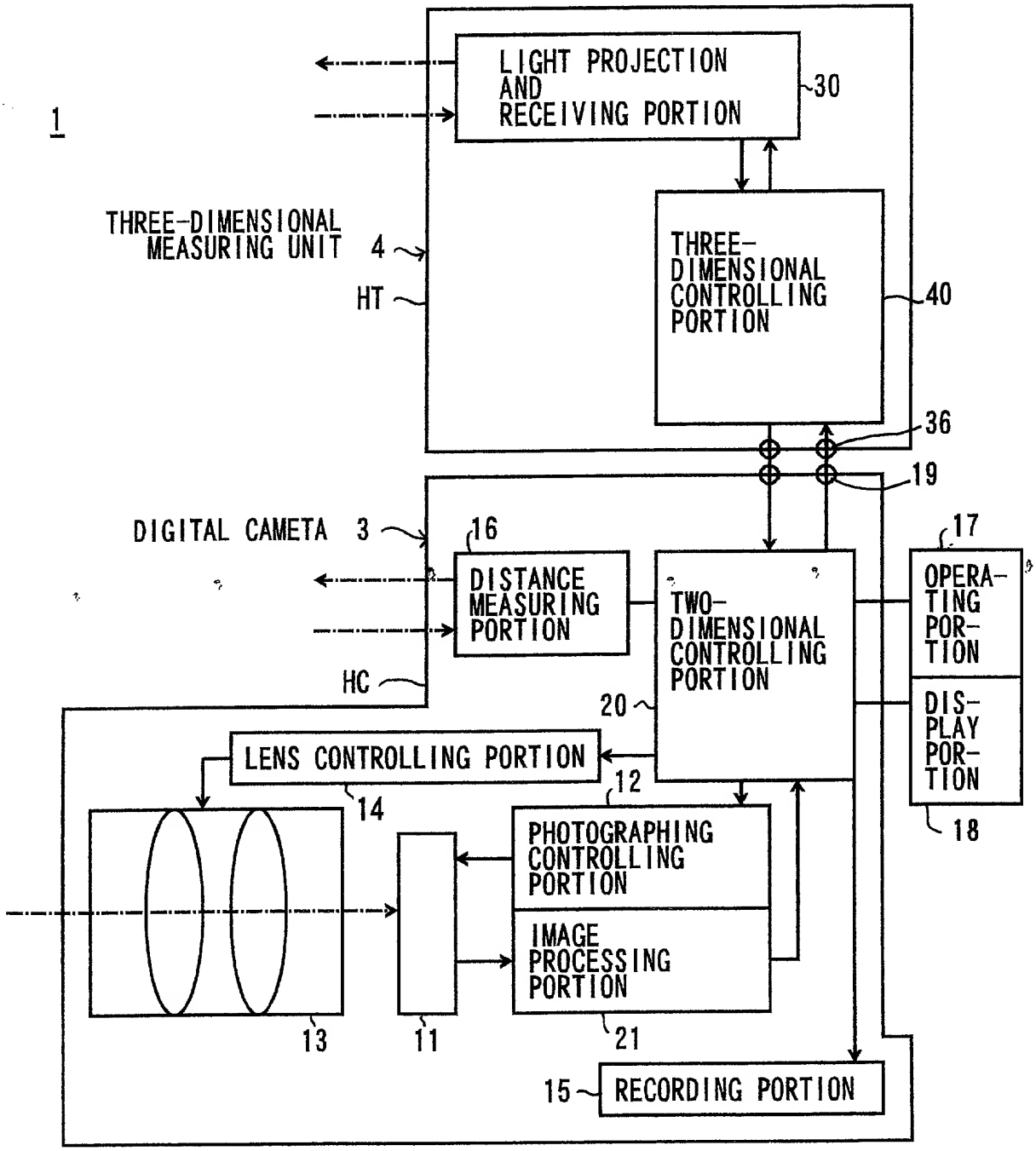

1
LIGHT PROJECTION AND RECEIVING PORTION
30
THREE-DIMENSIONAL MEASURING UNIT
4
HT
THREE-DIMENSIONAL CONTROLLING PORTION
40
36
19
DIGITAL CAMETA
3
16
DISTANCE MEASURING PORTION
HC
TWO-DIMENSIONAL CONTROLLING PORTION
20
17
OPERATING PORTION
DISPLAY PORTION
18
LENS CONTROLLING PORTION
14
12
PHOTOGRAPHING CONTROLLING PORTION
IMAGE PROCESSING PORTION
13
11
21
15
RECORDING PORTION

FIG. 2

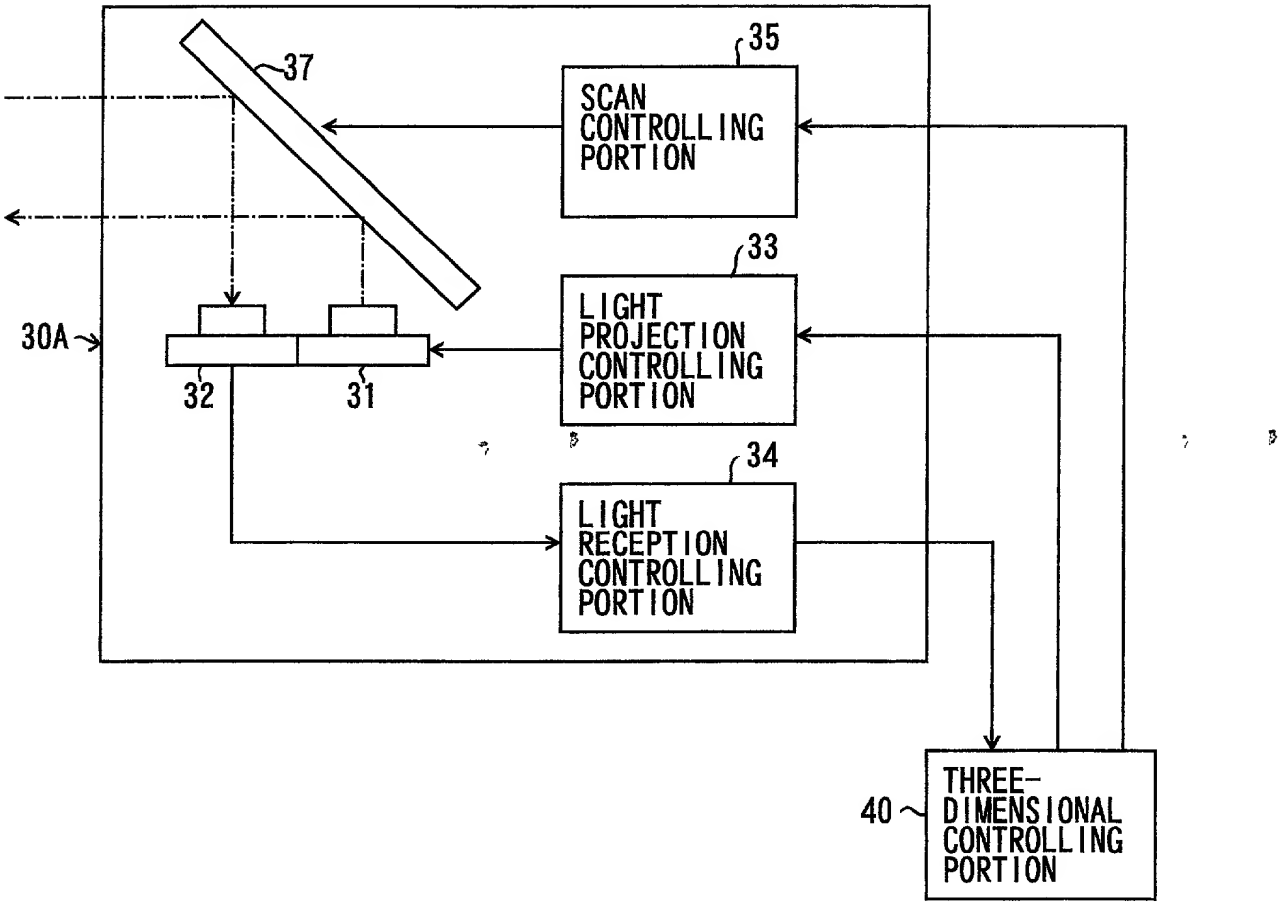

37
35
SCAN CONTROLLING PORTION
33
LIGHT PROJECTION CONTROLLING PORTION
30A
32
31
34
LIGHT RECEPTION CONTROLLING PORTION
40
THREE-DIMENSIONAL CONTROLLING PORTION

FIG. 3

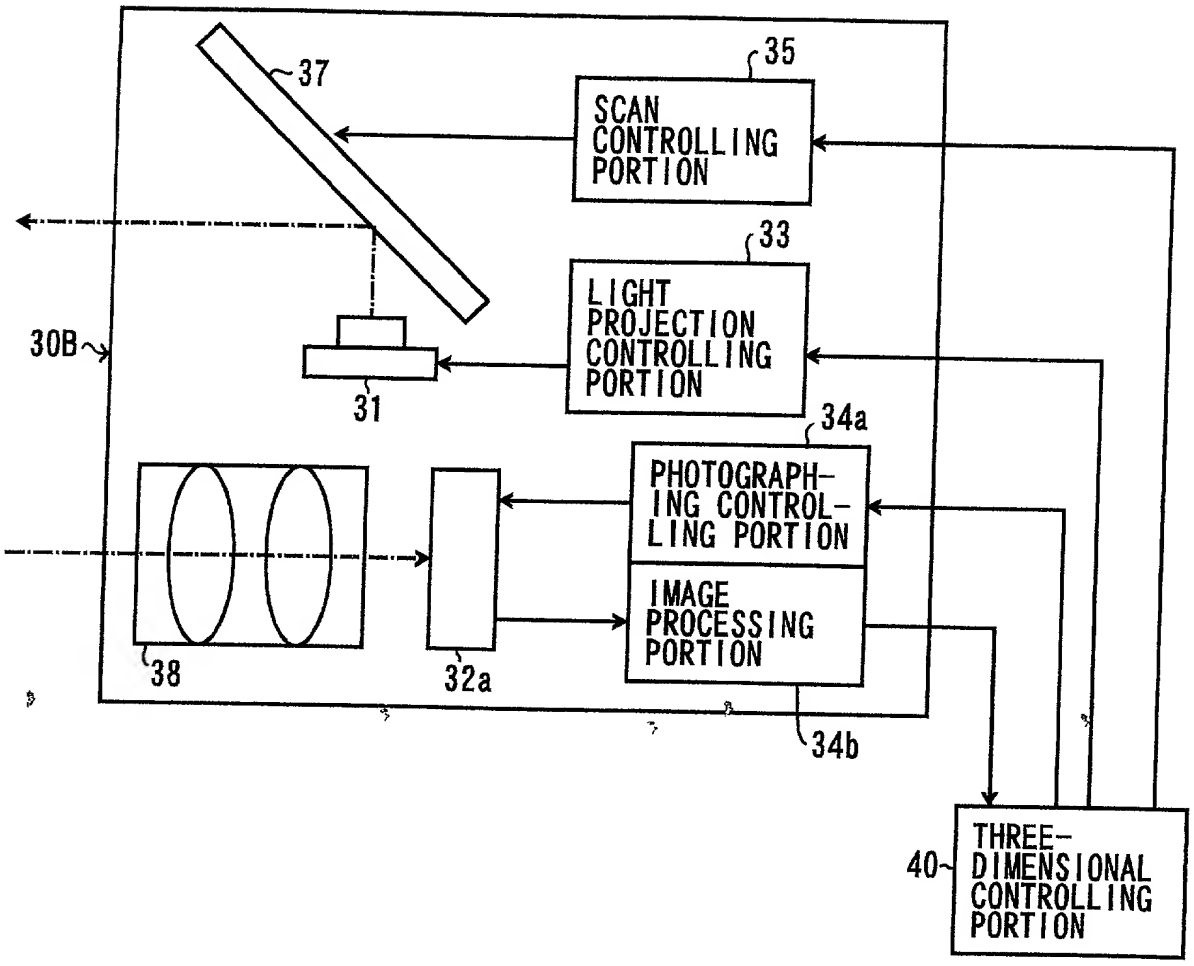

37
35
SCAN CONTROLLING PORTION
33
LIGHT PROJECTION CONTROLLING PORTION
30B
31
34a
PHOTOGRAPH-ING CONTROL-LING PORTION
IMAGE PROCESSING PORTION
38
32a
34b
40
THREE-DIMENSIONAL CONTROLLING PORTION

FIG. 4

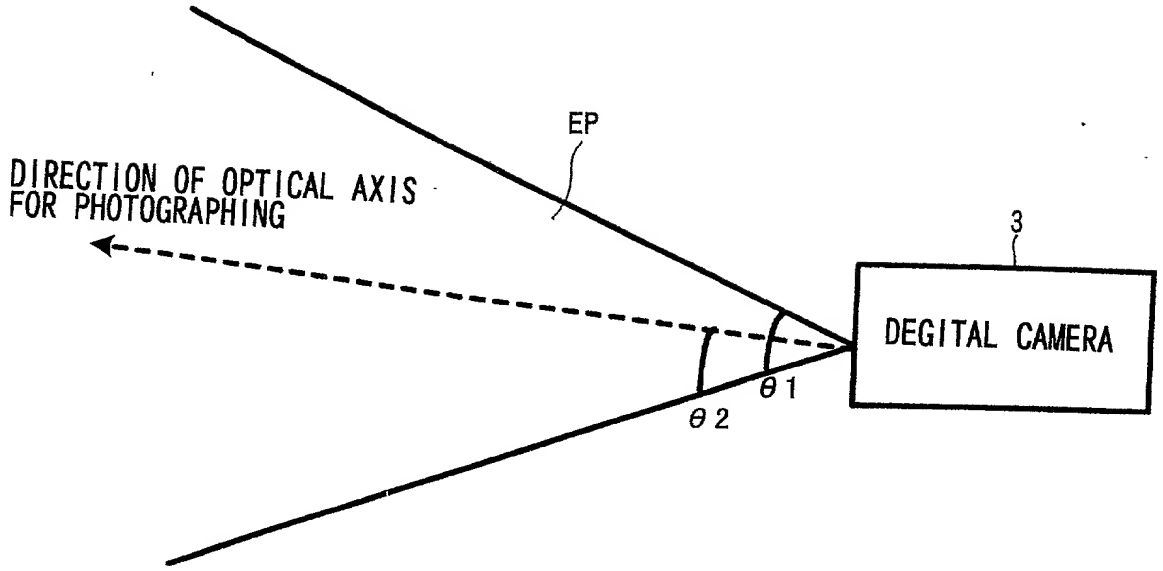

EP
DIRECTION OF OPTICAL AXIS
FOR PHOTOGRAPHING
3
DEGITAL CAMERA
θ1
θ2

FIG. 5

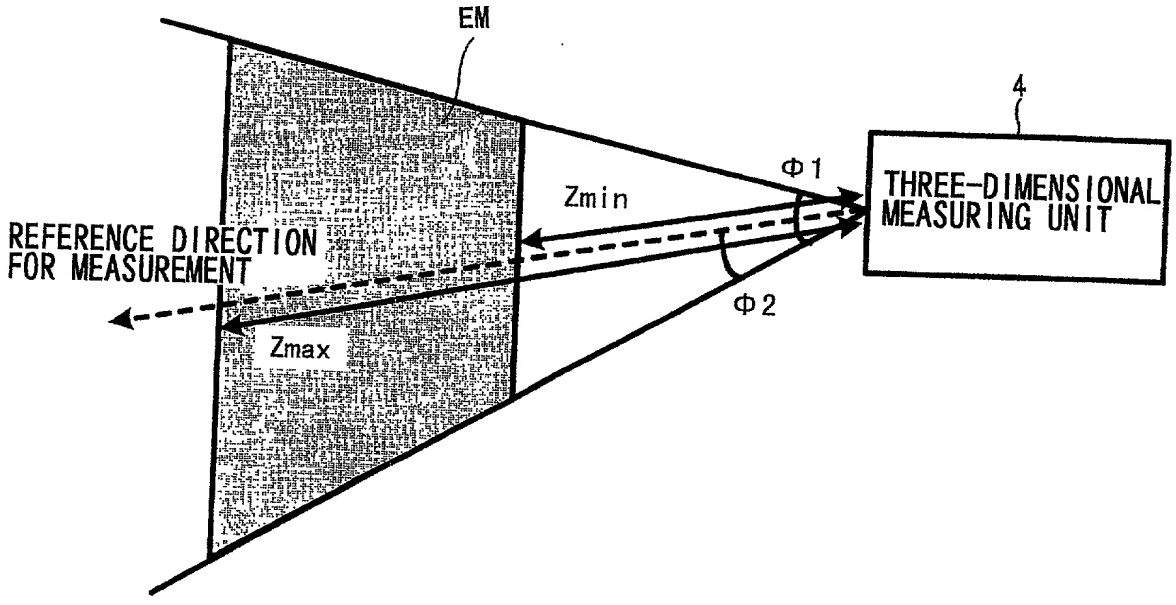

EM
4
Φ1
Zmin
THREE-DIMENSIONAL
MEASURING UNIT
REFERENCE DIRECTION
FOR MEASUREMENT
Φ2
Zmax

FIG. 6

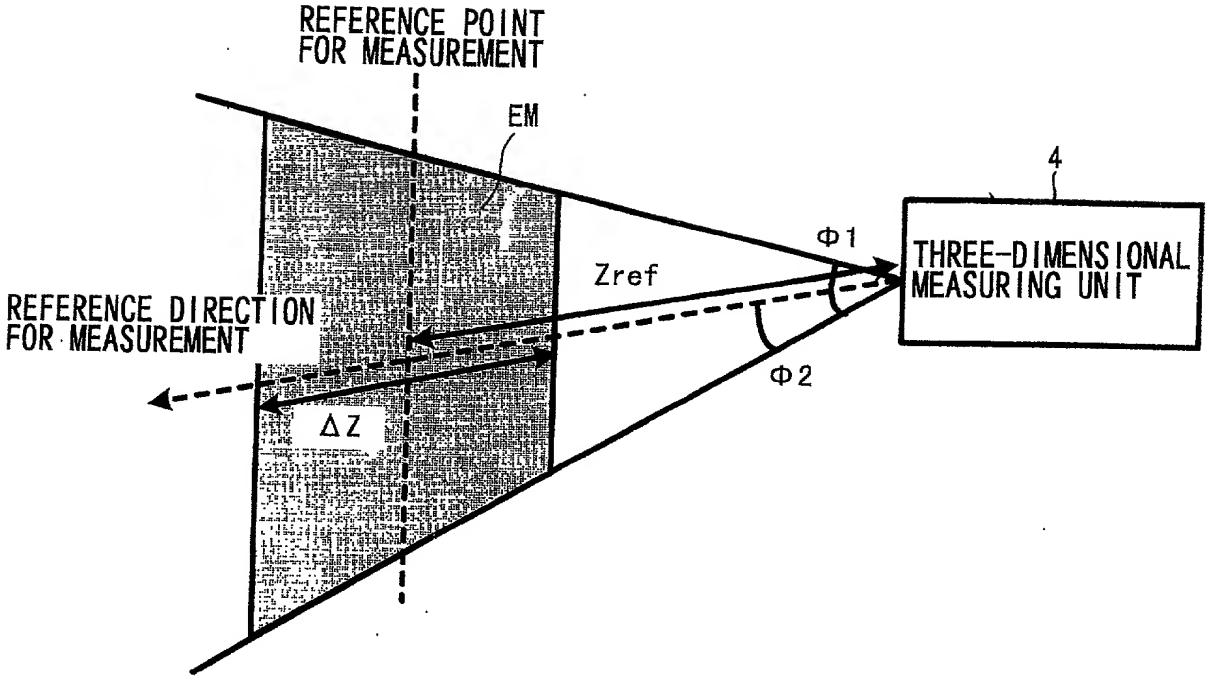

REFERENCE POINT
FOR MEASUREMENT
EM
4
Φ1
THREE-DIMENSIONAL
MEASURING UNIT
Zref
REFERENCE DIRECTION
FOR MEASUREMENT
Φ2
ΔZ

FIG. 7

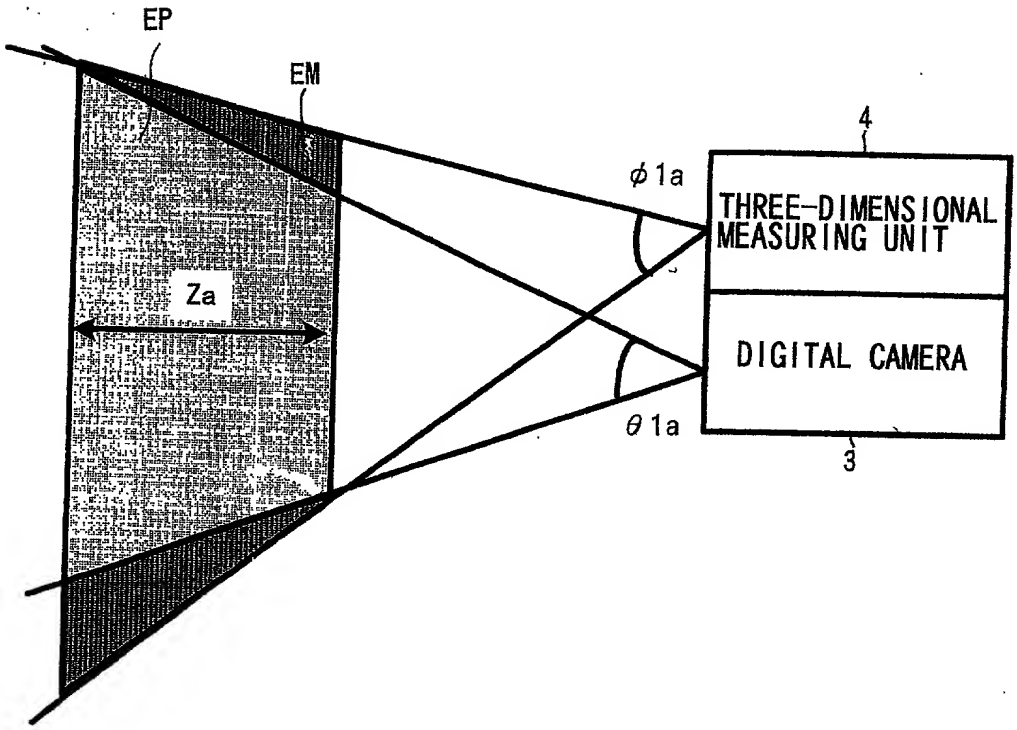

EP
EM
4
φ1a
THREE-DIMENSIONAL
MEASURING UNIT
Za
DIGITAL CAMERA
θ1a
3

FIG. 8

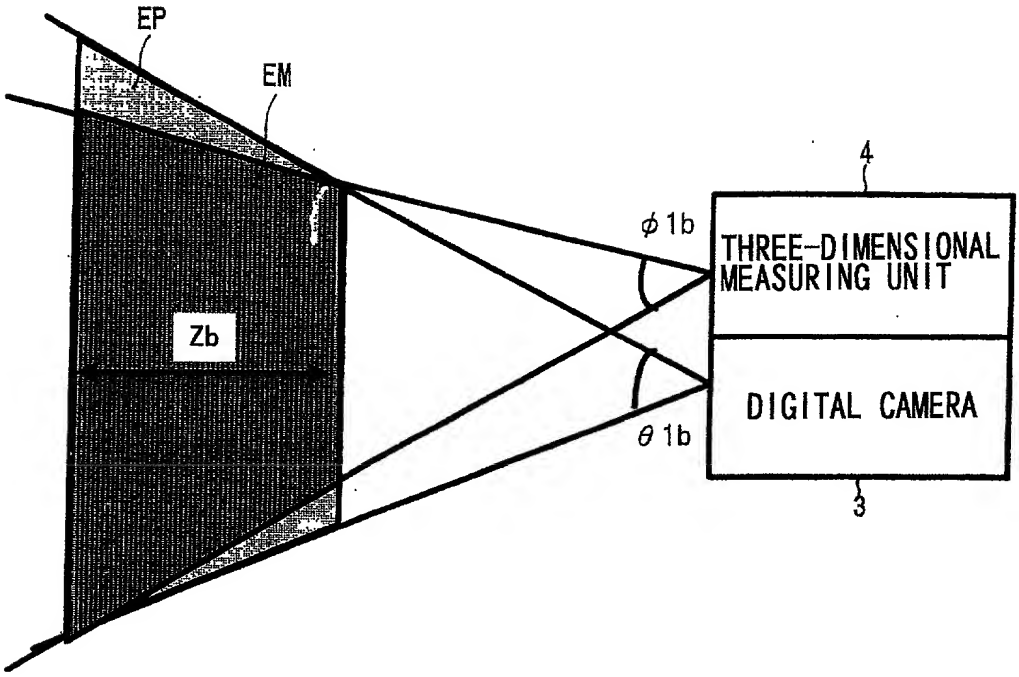

EP
EM
4
φ1b
THREE-DIMENSIONAL MEASURING UNIT
Zb
DIGITAL CAMERA
θ1b
3

FIG. 9

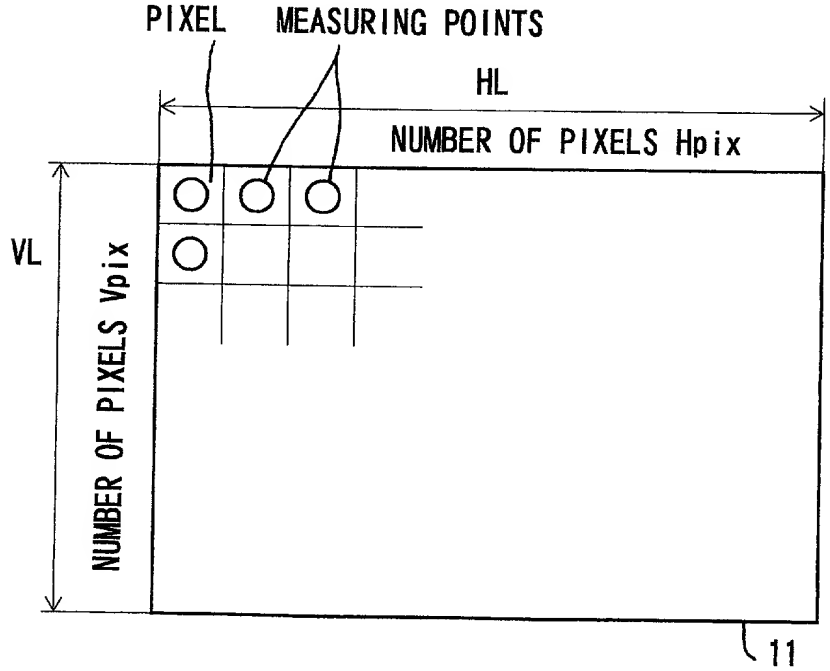

PIXEL
MEASURING POINTS
HL
NUMBER OF PIXELS Hpix
VL
NUMBER OF PIXELS Vpix
11

FIG. 10

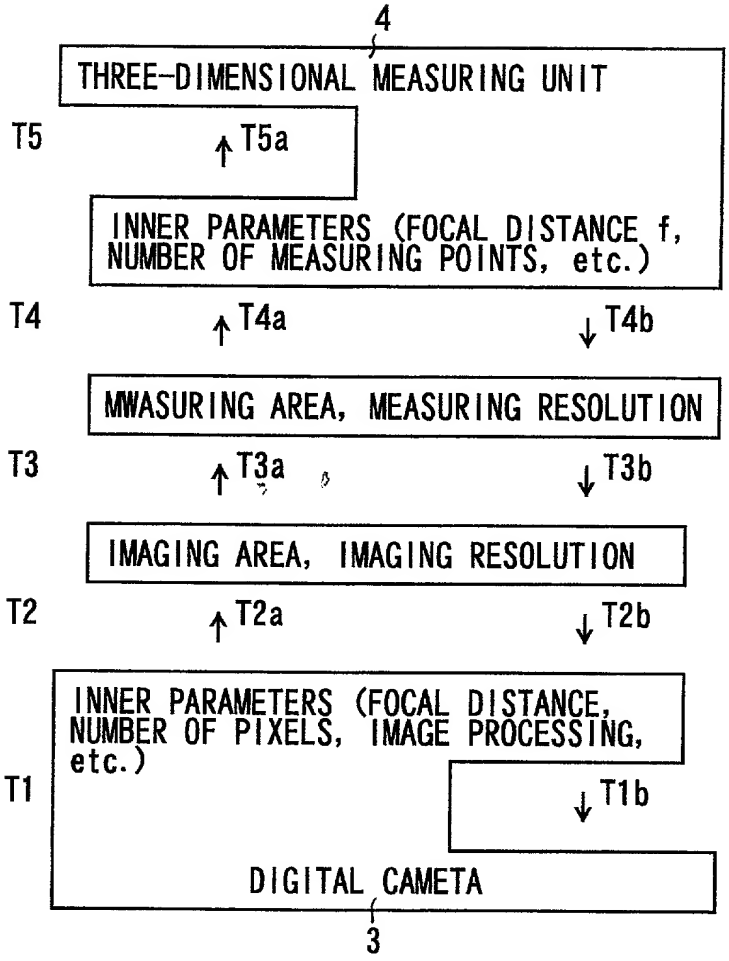

4
THREE-DIMENSIONAL MEASURING UNIT
T5
T5a
INNER PARAMETERS (FOCAL DISTANCE f, NUMBER OF MEASURING POINTS, etc.)
T4
T4a
T4b
MWASURING AREA, MEASURING RESOLUTION
T3
T3a
T3b
IMAGING AREA, IMAGING RESOLUTION
T2
T2a
T2b
INNER PARAMETERS (FOCAL DISTANCE, NUMBER OF PIXELS, IMAGE PROCESSING, etc.)
T1
T1b
DIGITAL CAMETA
3

FIG. 11

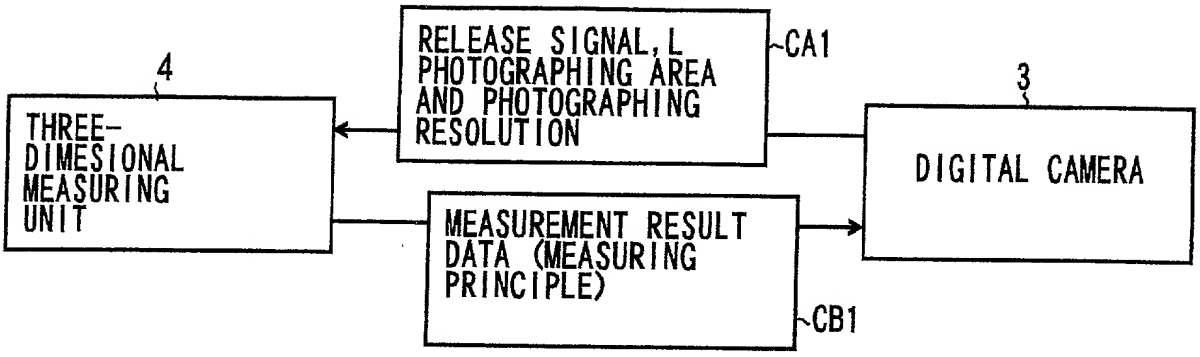


FIG. 12

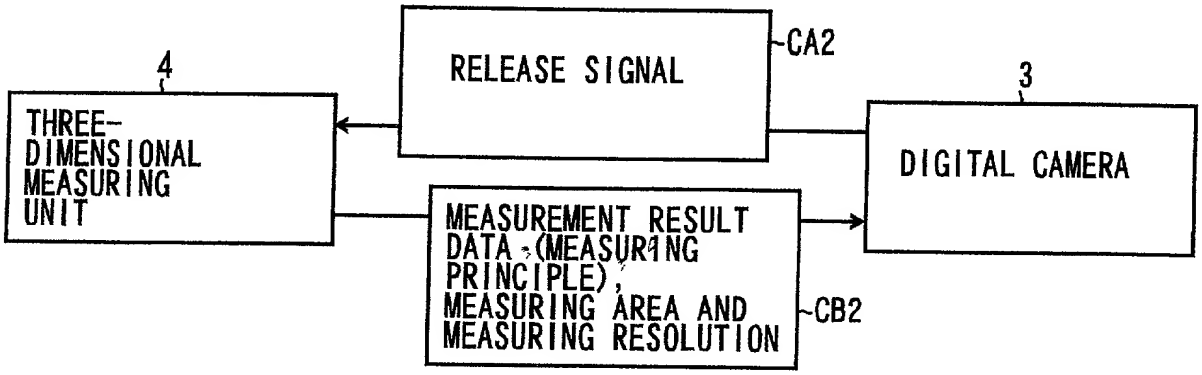


FIG. 13

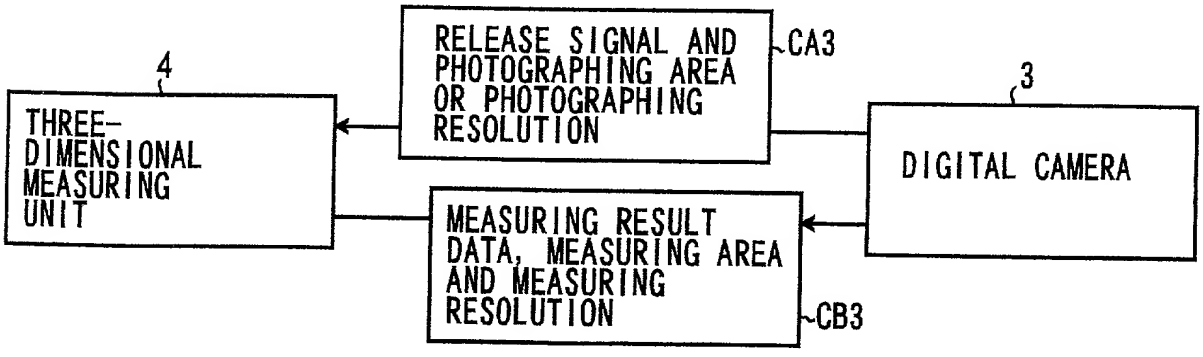


FIG. 14

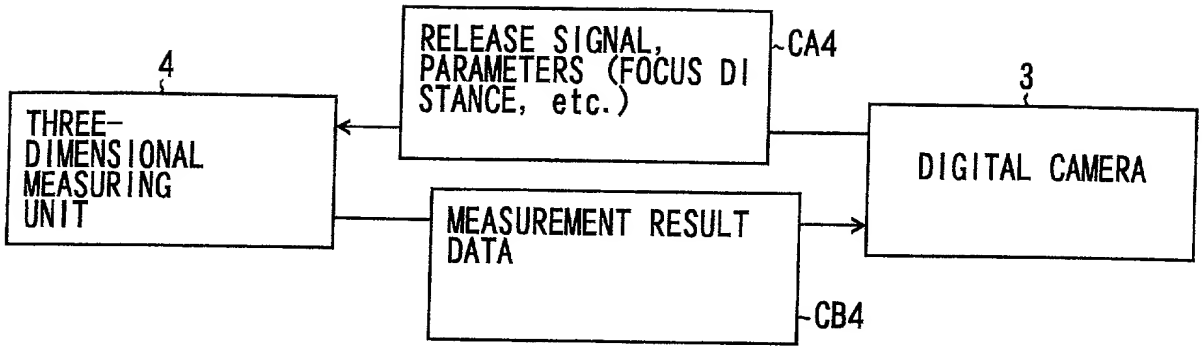


FIG. 15

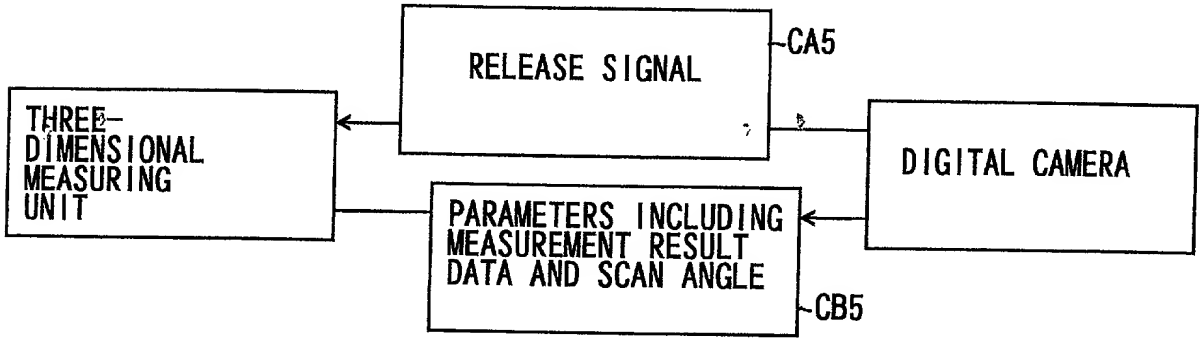


FIG. 16

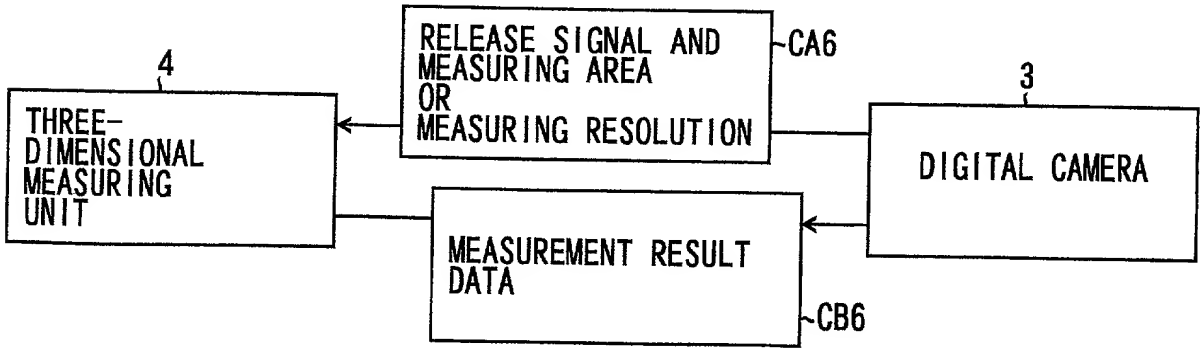


FIG. 17

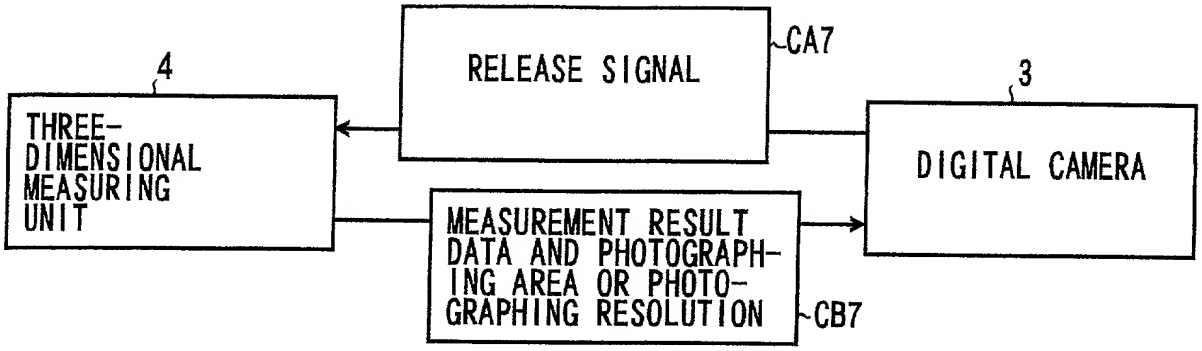


FIG. 18

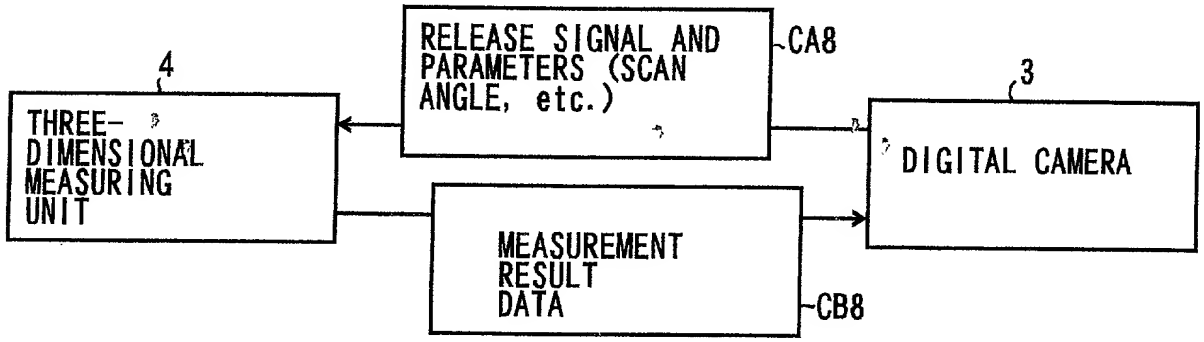


FIG. 19

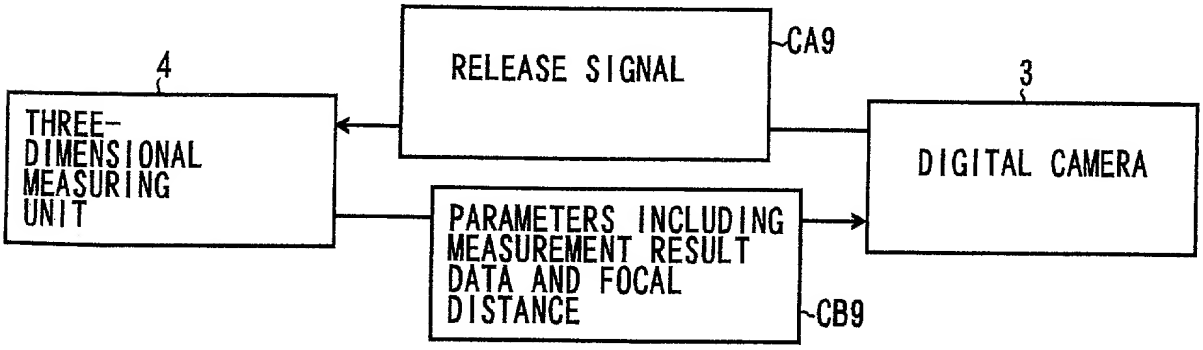


FIG. 20

HG1

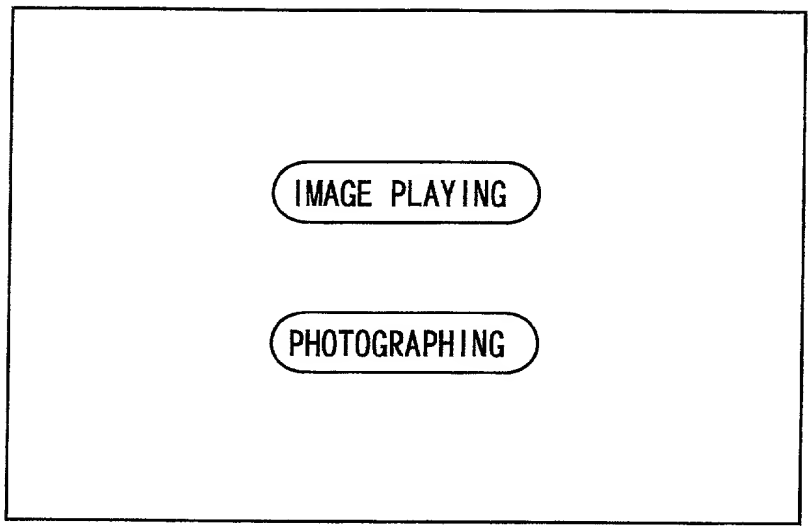


FIG. 21

HG2

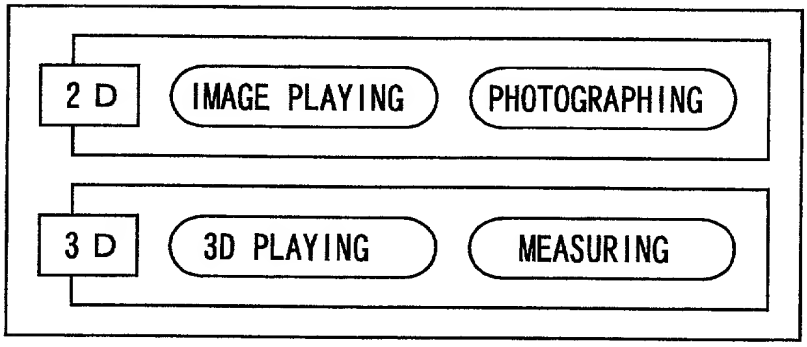


FIG. 22

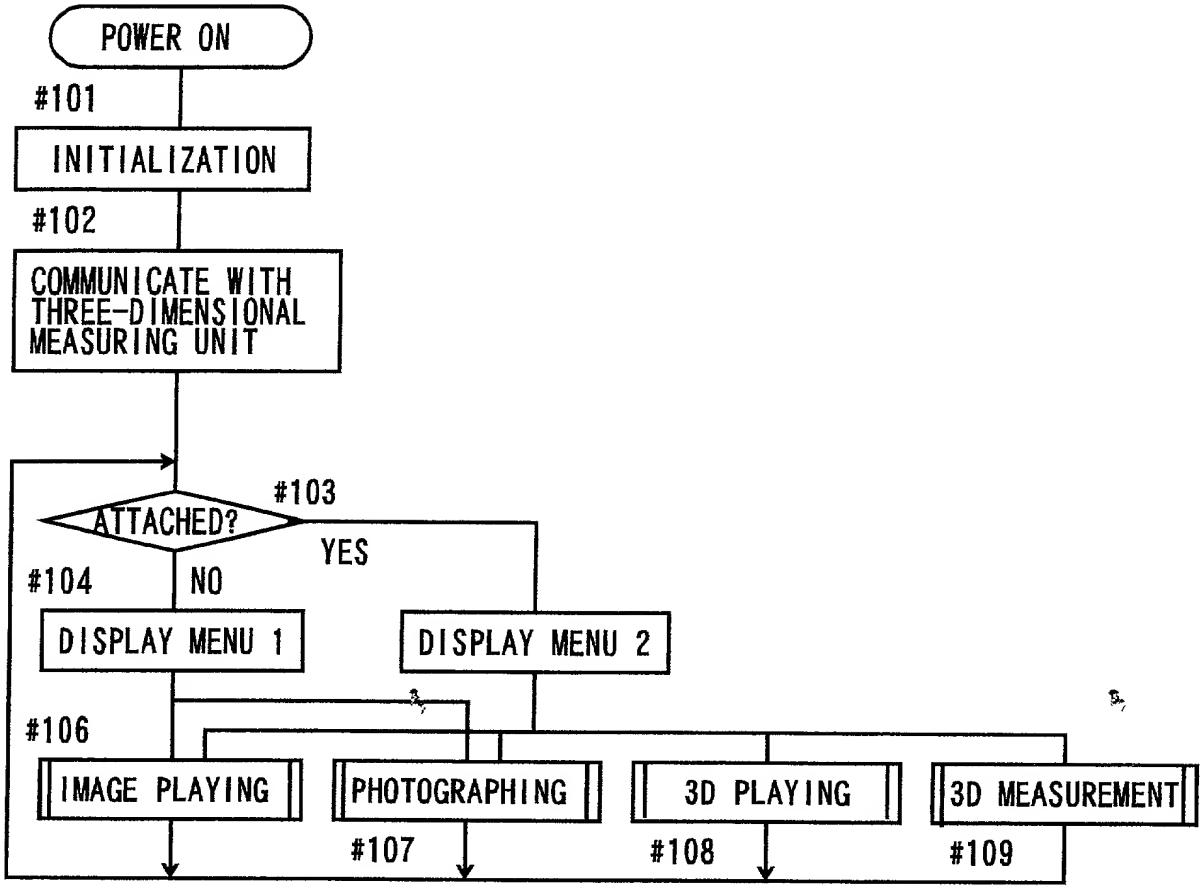

POWER ON
#101
INITIALIZATION
#102
COMMUNICATE WITH THREE-DIMENSIONAL MEASURING UNIT
#103
ATTACHED?
YES
#104
NO
DISPLAY MENU 1
DISPLAY MENU 2
#106
IMAGE PLAYING
PHOTOGRAPHING
3D PLAYING
3D MEASUREMENT
#107
#108
#109

FIG. 23

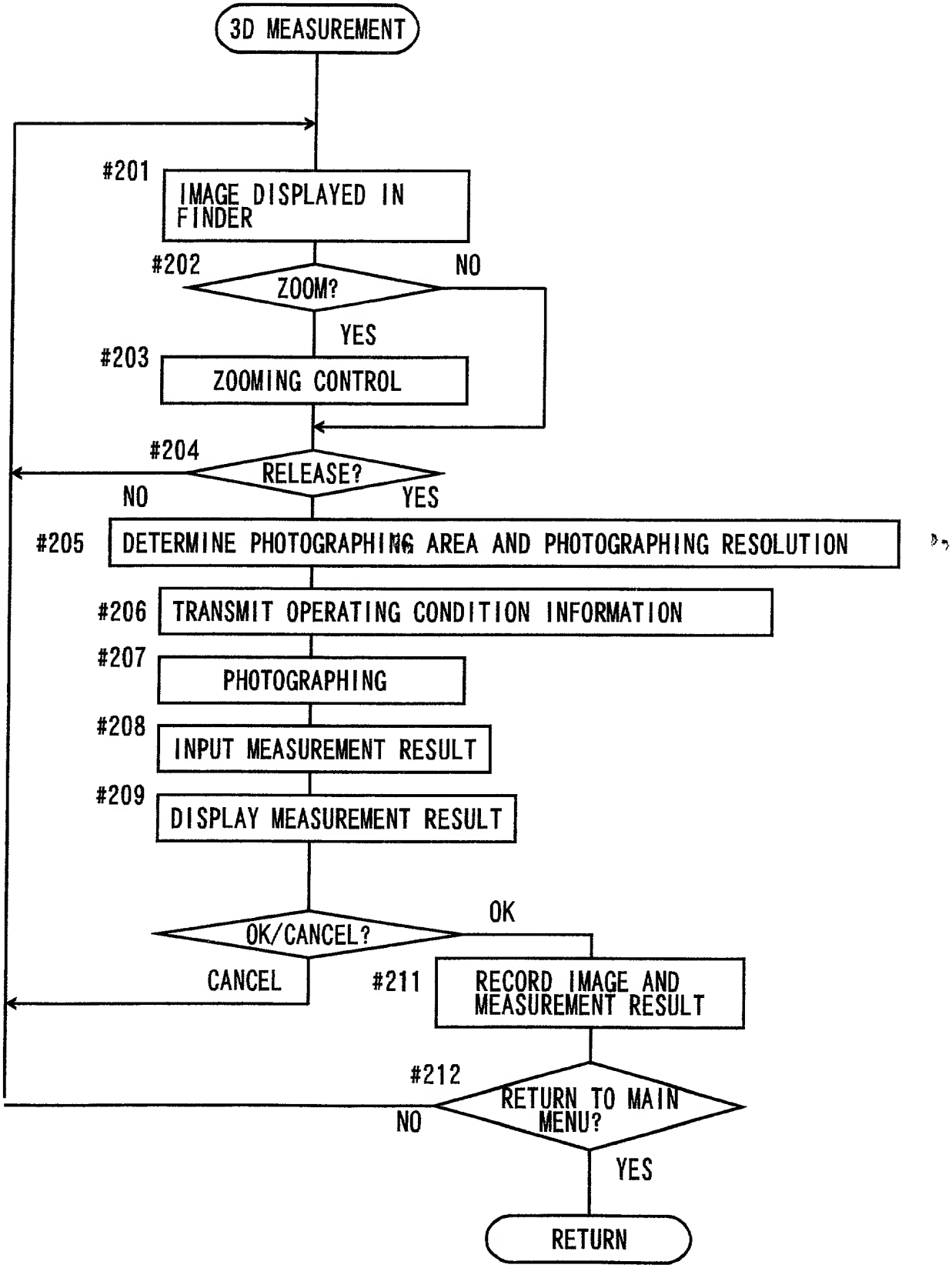

3D MEASUREMENT
#201
IMAGE DISPLAYED IN FINDER
#202
ZOOM?
NO
YES
#203
ZOOMING CONTROL
#204
RELEASE?
NO
YES
#205
DETERMINE PHOTOGRAPHING AREA AND PHOTOGRAPHING RESOLUTION
#206
TRANSMIT OPERATING CONDITION INFORMATION
#207
PHOTOGRAPHING
#208
INPUT MEASUREMENT RESULT
#209
DISPLAY MEASUREMENT RESULT
OK/CANCEL?
OK
CANCEL
#211
RECORD IMAGE AND MEASUREMENT RESULT
#212
RETURN TO MAIN MENU?
NO
YES
RETURN

FIG. 24

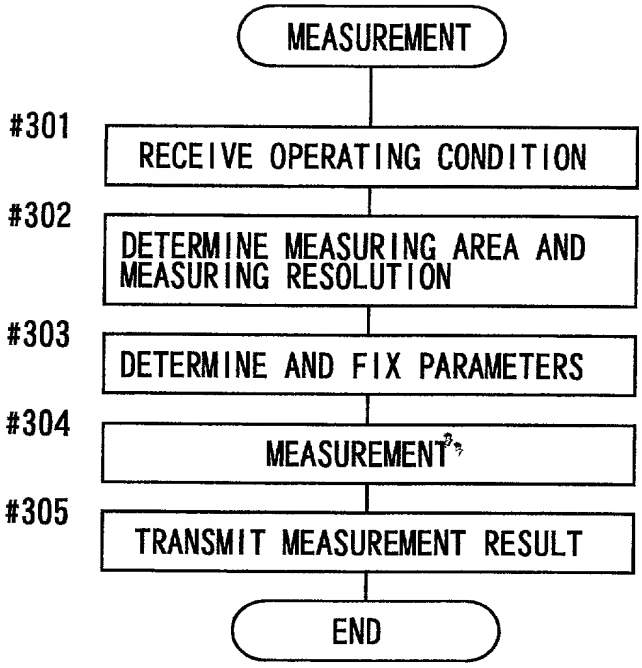

MEASUREMENT
#301
RECEIVE OPERATING CONDITION
#302
DETERMINE MEASURING AREA AND MEASURING RESOLUTION
#303
DETERMINE AND FIX PARAMETERS
#304
MEASUREMENT
#305
TRANSMIT MEASUREMENT RESULT
END

FIG. 25

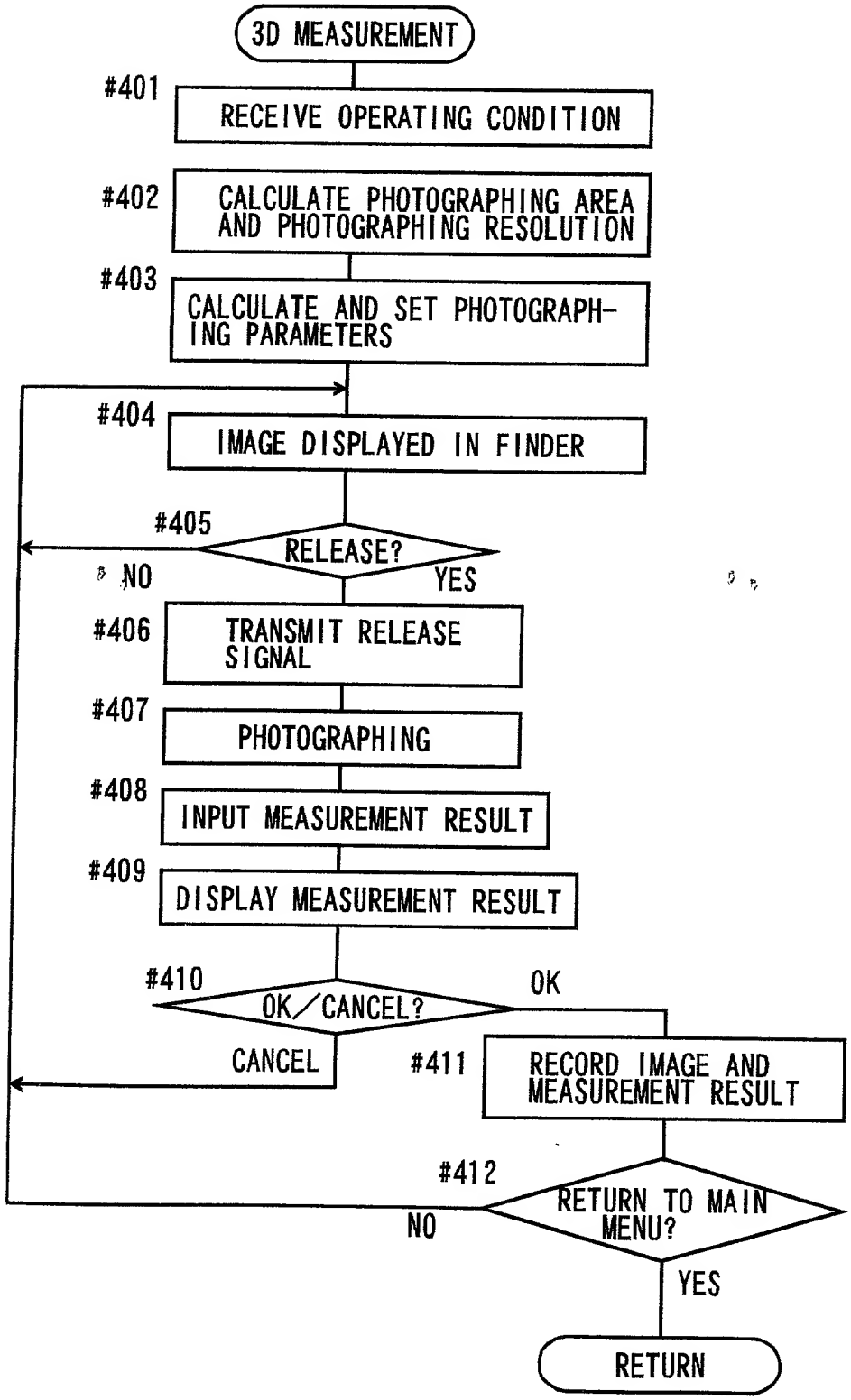

3D MEASUREMENT
#401
RECEIVE OPERATING CONDITION
#402
CALCULATE PHOTOGRAPHING AREA AND PHOTOGRAPHING RESOLUTION
#403
CALCULATE AND SET PHOTOGRAPHING PARAMETERS
#404
IMAGE DISPLAYED IN FINDER
#405
RELEASE?
NO
YES
#406
TRANSMIT RELEASE SIGNAL
#407
PHOTOGRAPHING
#408
INPUT MEASUREMENT RESULT
#409
DISPLAY MEASUREMENT RESULT
#410
OK/CANCEL?
OK
CANCEL
#411
RECORD IMAGE AND MEASUREMENT RESULT
#412
RETURN TO MAIN MENU?
NO
YES
RETURN

FIG. 26

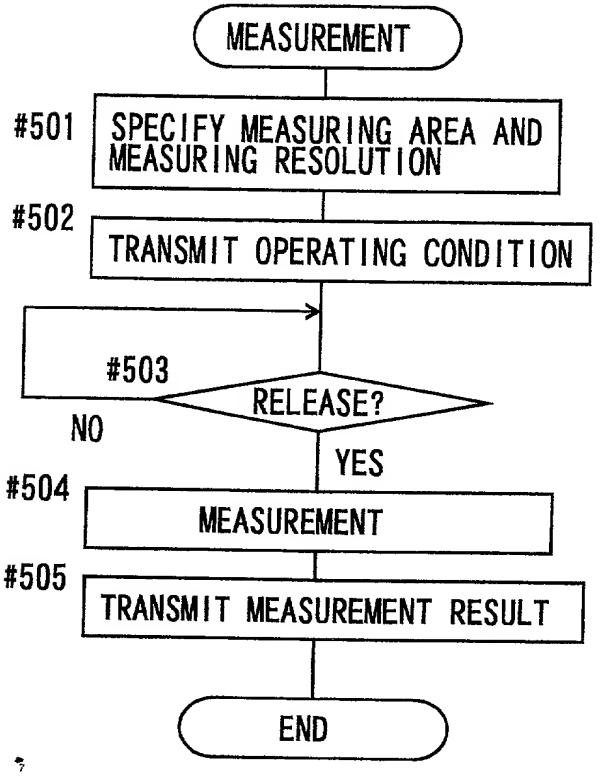

MEASUREMENT
#501
SPECIFY MEASURING AREA AND MEASURING RESOLUTION
#502
TRANSMIT OPERATING CONDITION
#503
RELEASE?
NO
YES
#504
MEASUREMENT
#505
TRANSMIT MEASUREMENT RESULT
END

FIG. 27

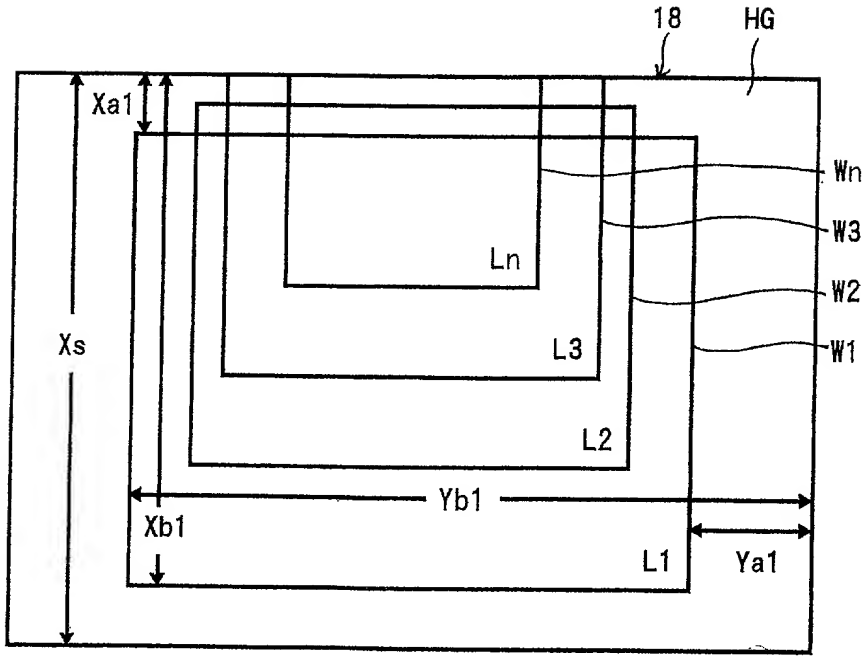

18
HG
Xa1
Wn
W3
W2
W1
Ln
L3
L2
Xs
Yb1
Xb1
L1
Ya1

FIG. 28

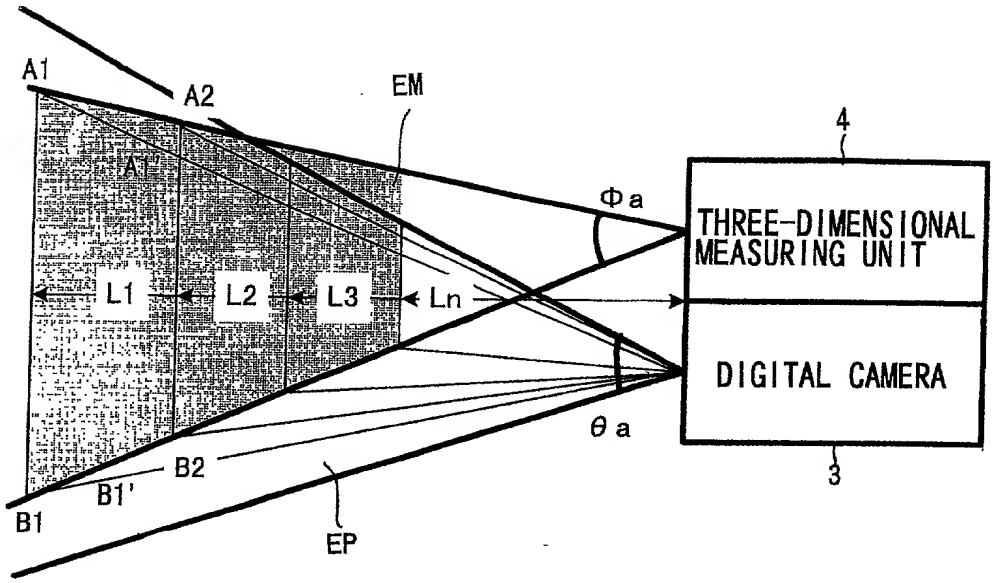

A1
A2
EM
4
A1'
Φa
THREE-DIMENSIONAL MEASURING UNIT
L1
L2
L3
Ln
DIGITAL CAMERA
θa
B2
B1'
B1
EP
3

FIG. 29

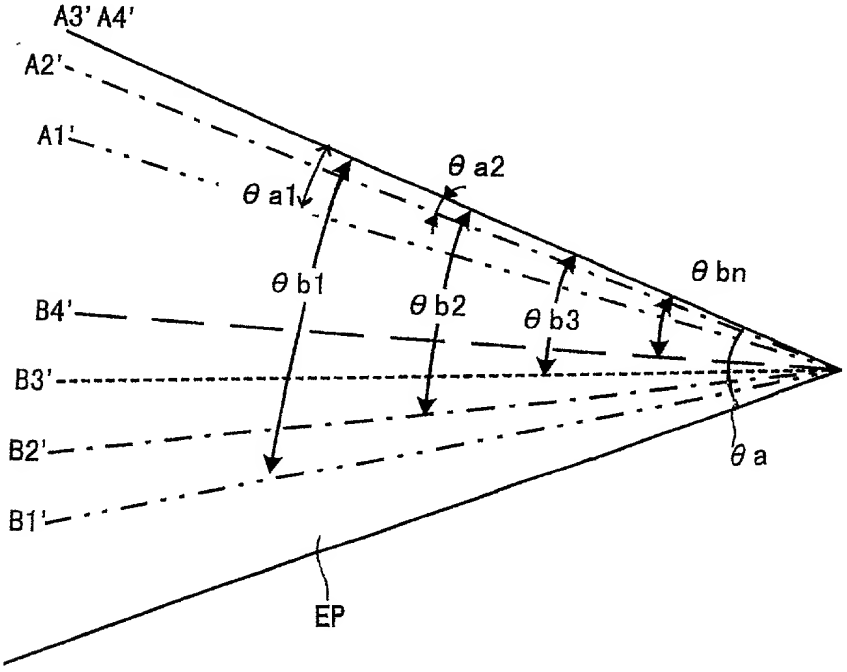

A3' A4'
A2'
A1'
θa1
θa2
θb1
θb2
θb3
θbn
B4'
B3'
B2'
θa
B1'
EP

FIG. 30

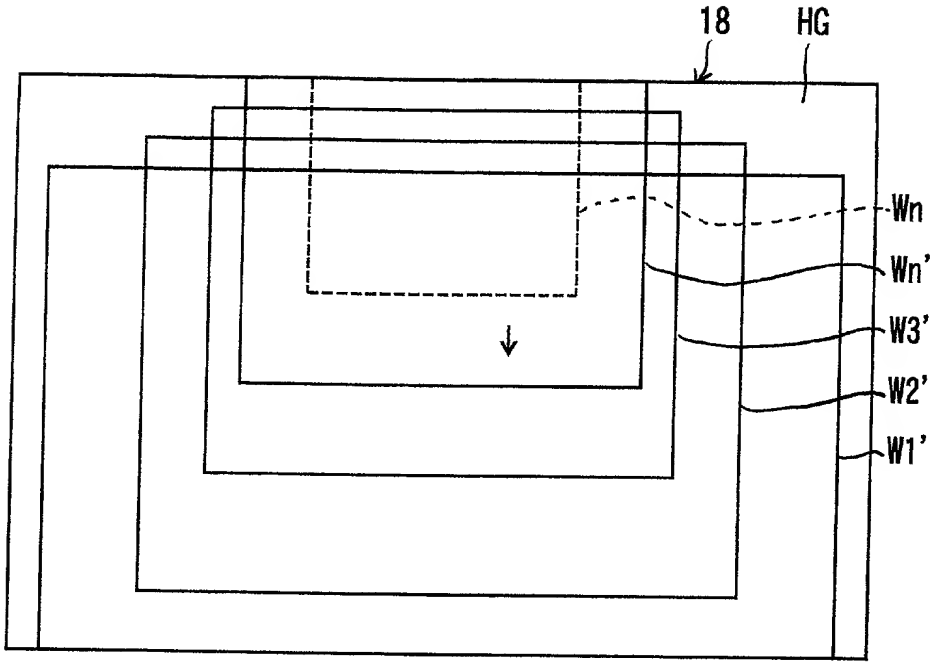


FIG. 31

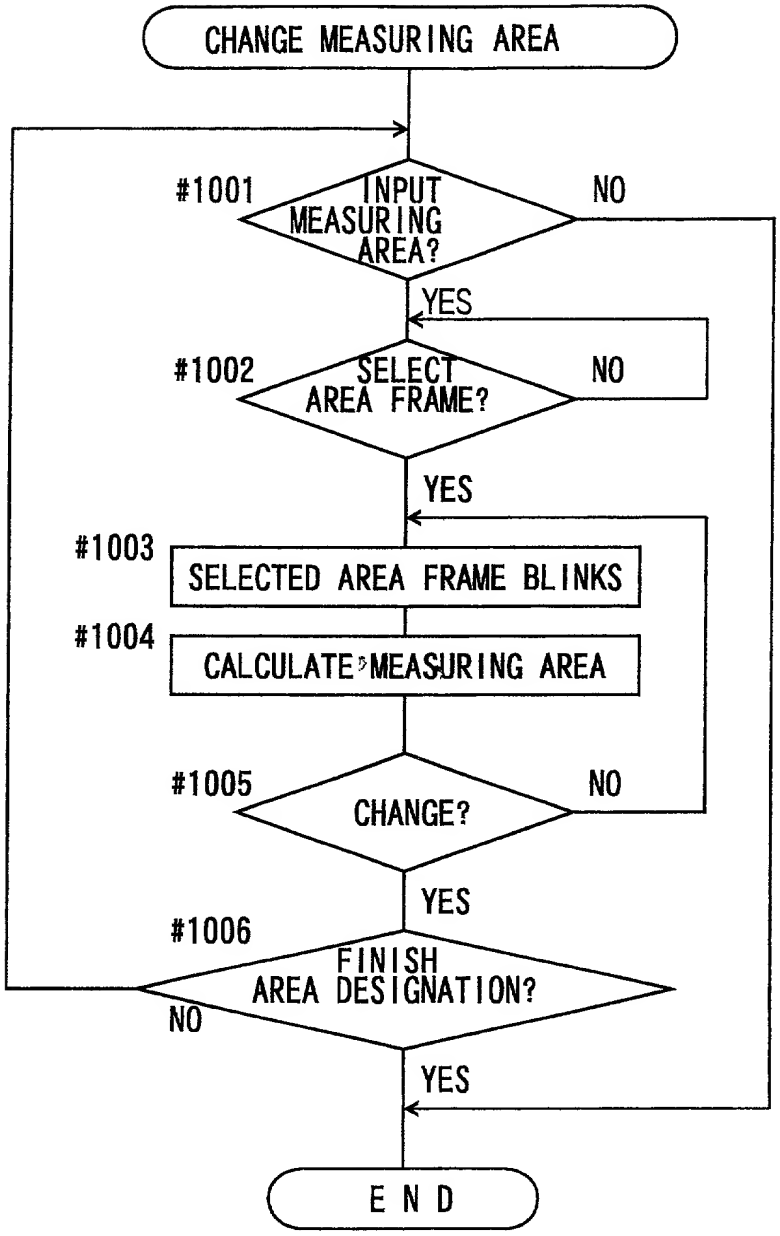

CHANGE MEASURING AREA
#1001
INPUT MEASURING AREA?
NO
YES
#1002
SELECT AREA FRAME?
NO
YES
#1003
SELECTED AREA FRAME BLINKS
#1004
CALCULATE MEASURING AREA
#1005
CHANGE?
NO
YES
#1006
FINISH AREA DESIGNATION?
NO
YES
E N D

FIG. 32

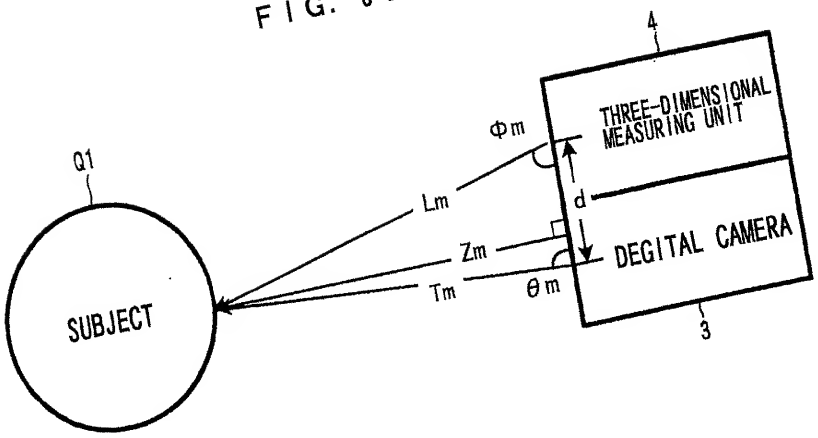

4
THREE-DIMENSIONAL MEASURING UNIT
Φm
Q1
Lm
d
Zm
DEGITAL CAMERA
Tm
θm
SUBJECT
3

FIG. 33

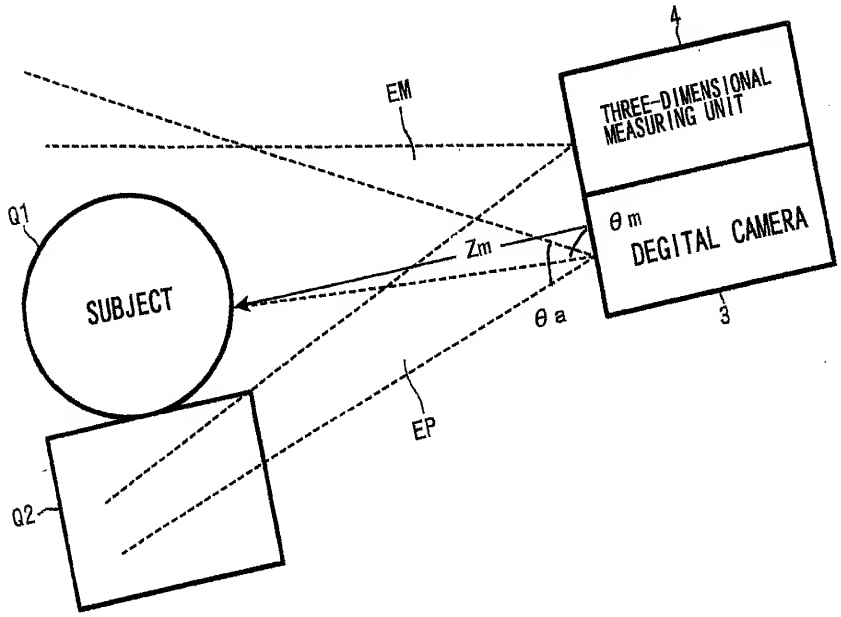

4
EM
THREE-DIMENSIONAL MEASURING UNIT
Q1
θm
Zm
DEGITAL CAMERA
SUBJECT
θa
3
EP
Q2

FIG. 34

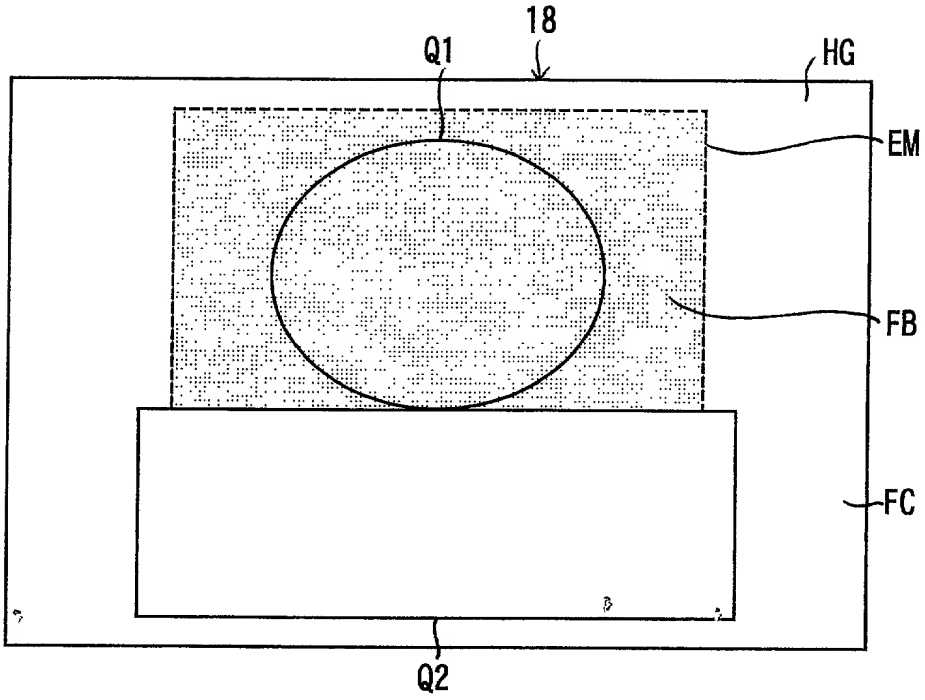


FIG. 35

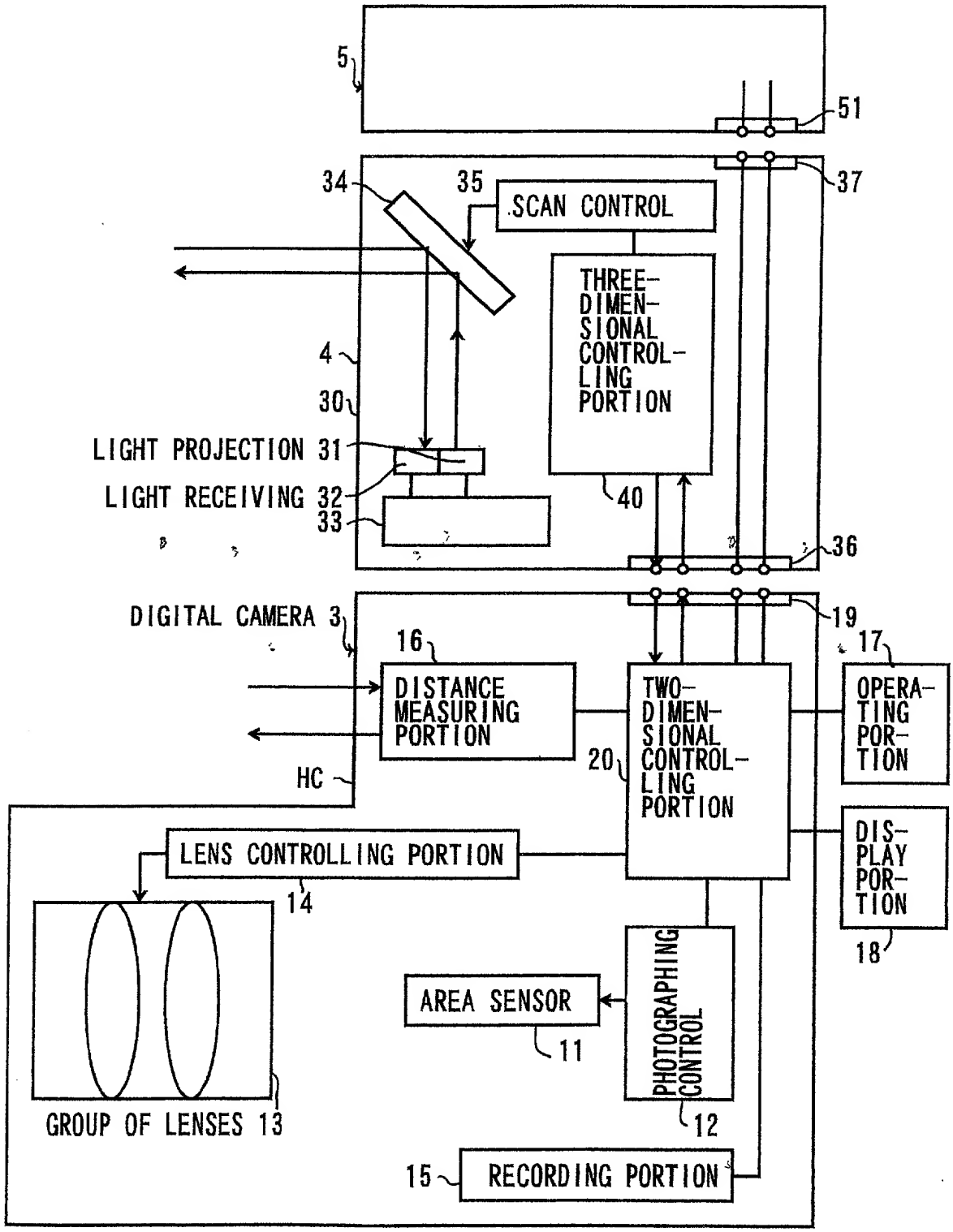
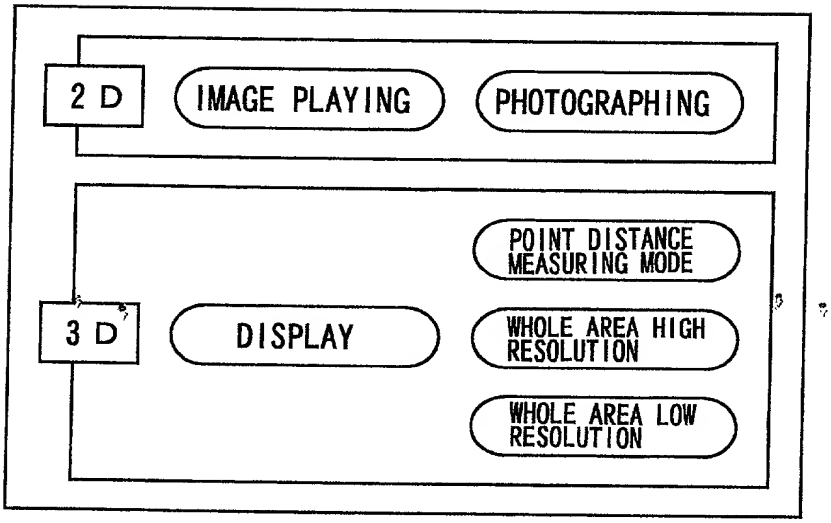

1B
5
51
34
35
SCAN CONTROL
37
THREE-DIMENSIONAL CONTROLLING PORTION
4
30
LIGHT PROJECTION 31
LIGHT RECEIVING 32
33
40
36
DIGITAL CAMERA 3
19
16
17
DISTANCE MEASURING PORTION
TWO-DIMENSIONAL CONTROLLING PORTION
OPERATING PORTION
HC
20
LENS CONTROLLING PORTION
14
DISPLAY PORTION
18
AREA SENSOR
11
PHOTOGRAPHING CONTROL
12
GROUP OF LENSES 13
15
RECORDING PORTION

FIG. 36

HG3


2 D
IMAGE PLAYING
PHOTOGRAPHING
3 D
DISPLAY
POINT DISTANCE MEASURING MODE
WHOLE AREA HIGH RESOLUTION
WHOLE AREA LOW RESOLUTION

HG4

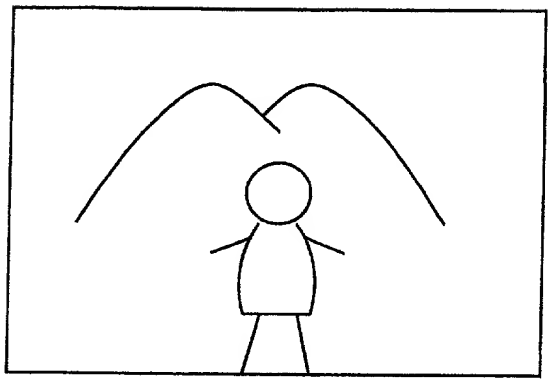


FIG. 37A

HG5

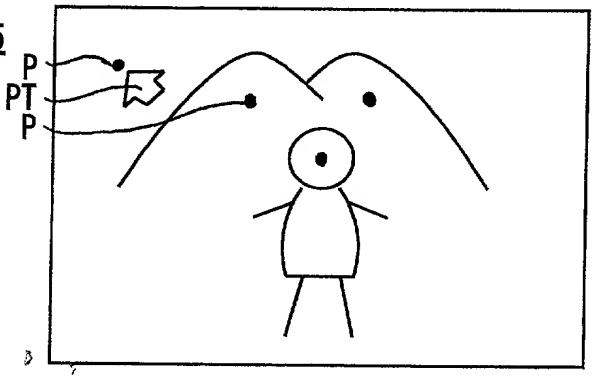


FIG. 37B

HG6

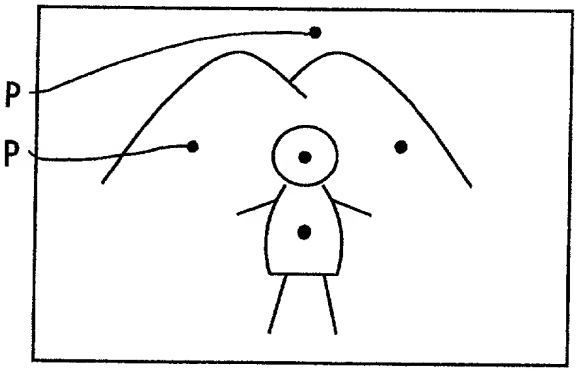


FIG. 37C

HG7

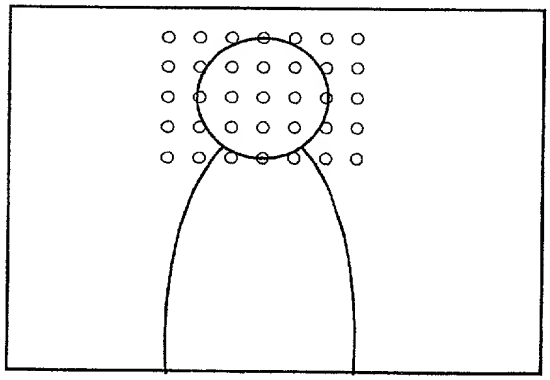


FIG. 37D

FIG. 38

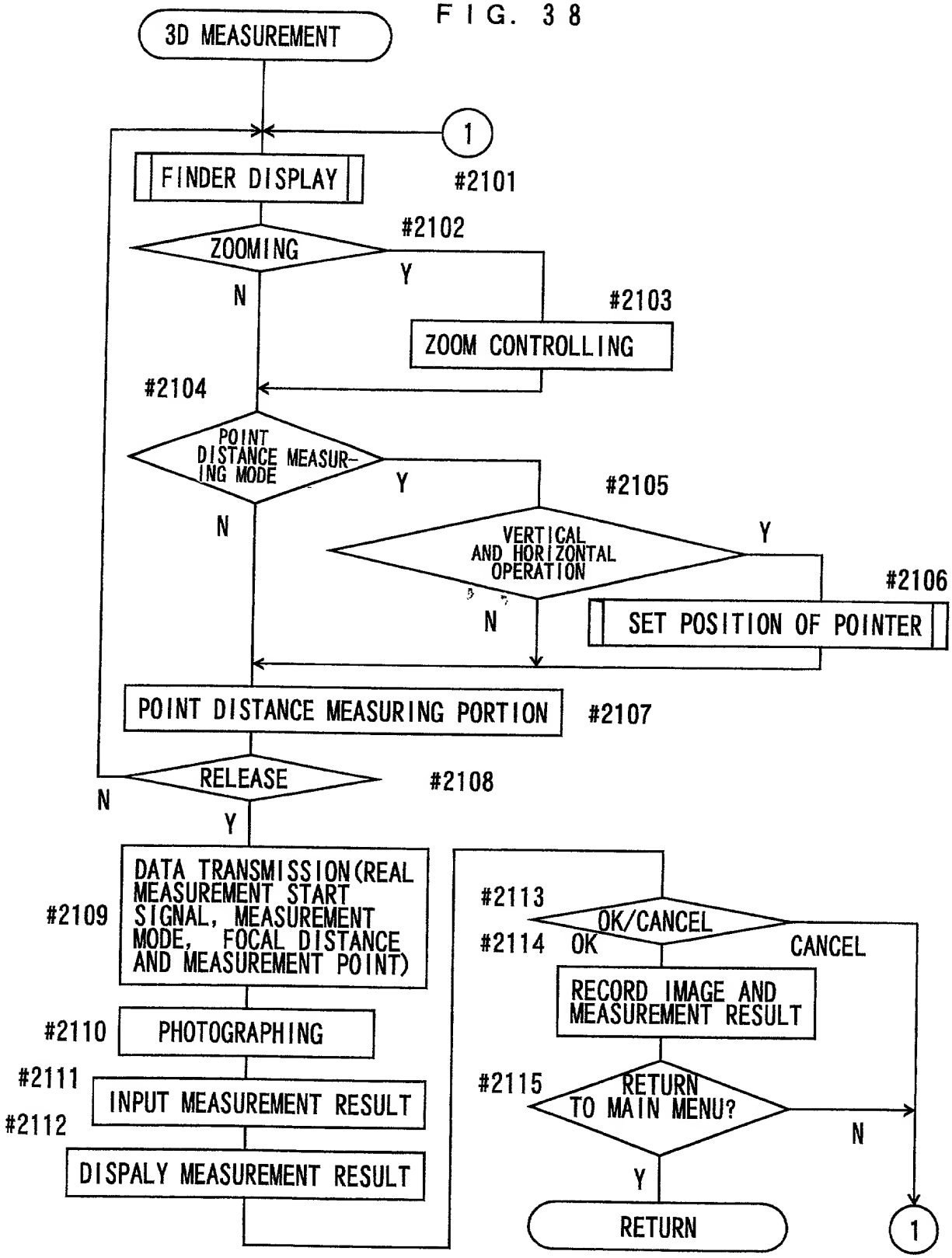

3D MEASUREMENT
1
FINDER DISPLAY
#2101
ZOOMING
#2102
Y
N
#2103
ZOOM CONTROLLING
#2104
POINT DISTANCE MEASURING MODE
Y
#2105
N
VERTICAL AND HORIZONTAL OPERATION
Y
#2106
N
SET POSITION OF POINTER
POINT DISTANCE MEASURING PORTION
#2107
RELEASE
#2108
N
Y
#2109
DATA TRANSMISSION(REAL MEASUREMENT START SIGNAL, MEASUREMENT MODE, FOCAL DISTANCE AND MEASUREMENT POINT)
#2110
PHOTOGRAPHING
#2111
INPUT MEASUREMENT RESULT
#2112
DISPALY MEASUREMENT RESULT
#2113
OK/CANCEL
#2114
OK
CANCEL
RECORD IMAGE AND MEASUREMENT RESULT
#2115
RETURN TO MAIN MENU?
N
Y
RETURN
1

FIG. 39

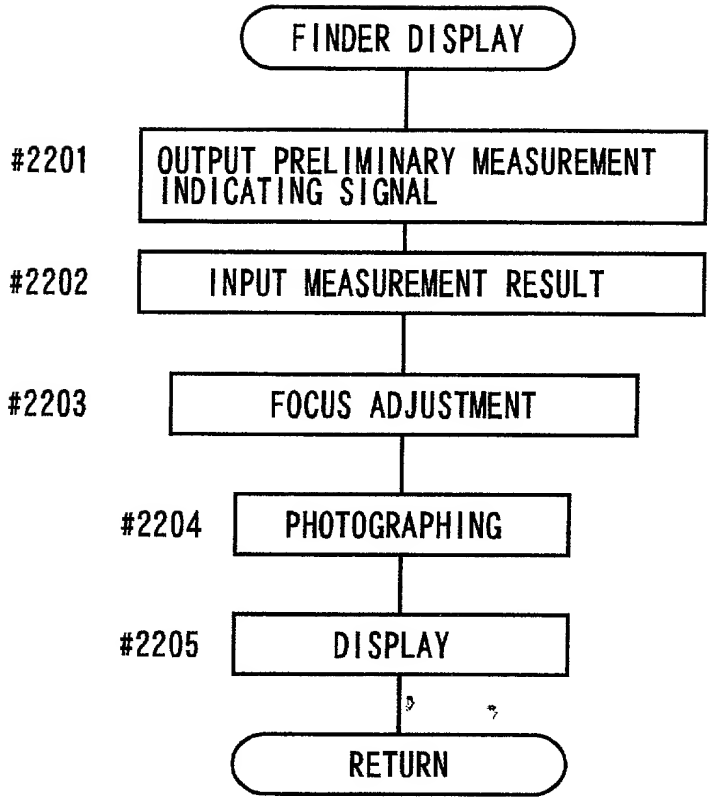

FINDER DISPLAY
#2201
OUTPUT PRELIMINARY MEASUREMENT INDICATING SIGNAL
#2202
INPUT MEASUREMENT RESULT
#2203
FOCUS ADJUSTMENT
#2204
PHOTOGRAPHING
#2205
DISPLAY
RETURN

FIG. 40

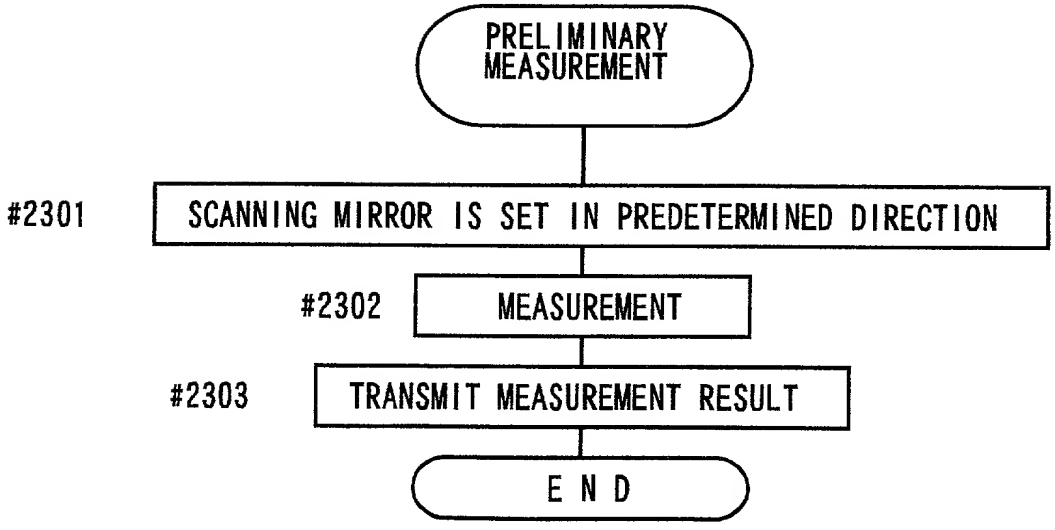

PRELIMINARY MEASUREMENT
#2301
SCANNING MIRROR IS SET IN PREDETERMINED DIRECTION
#2302
MEASUREMENT
#2303
TRANSMIT MEASUREMENT RESULT
E N D

FIG. 41

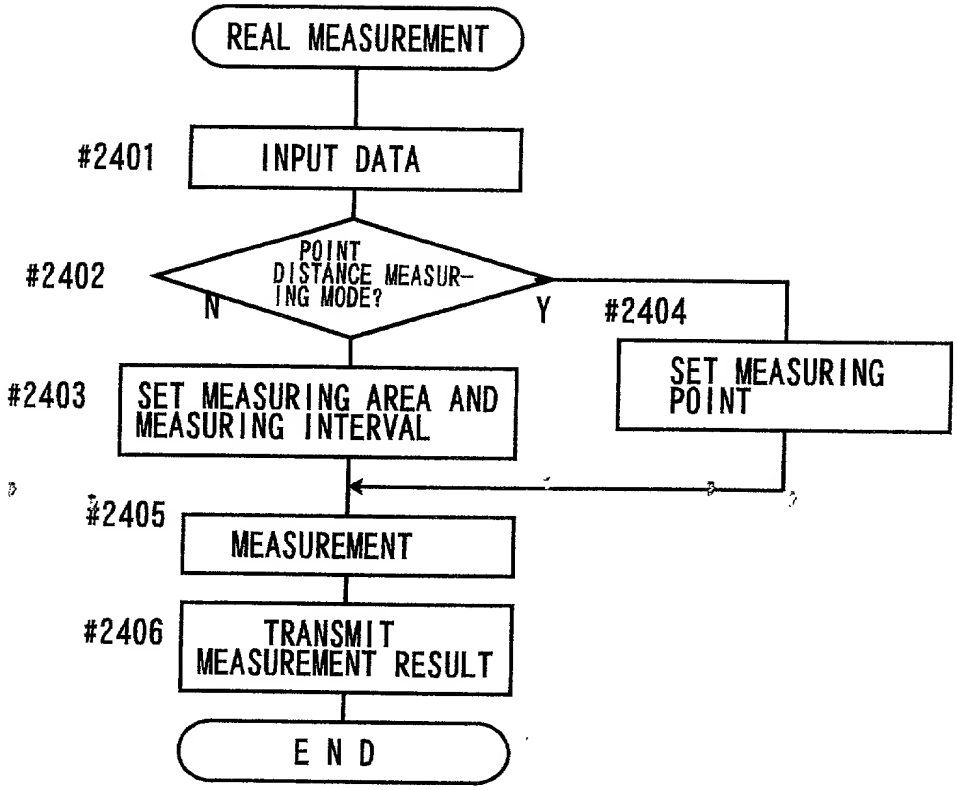

REAL MEASUREMENT
#2401
INPUT DATA
#2402
POINT DISTANCE MEASURING MODE?
N
Y
#2404
SET MEASURING POINT
#2403
SET MEASURING AREA AND MEASURING INTERVAL
#2405
MEASUREMENT
#2406
TRANSMIT MEASUREMENT RESULT
END

FIG. 42

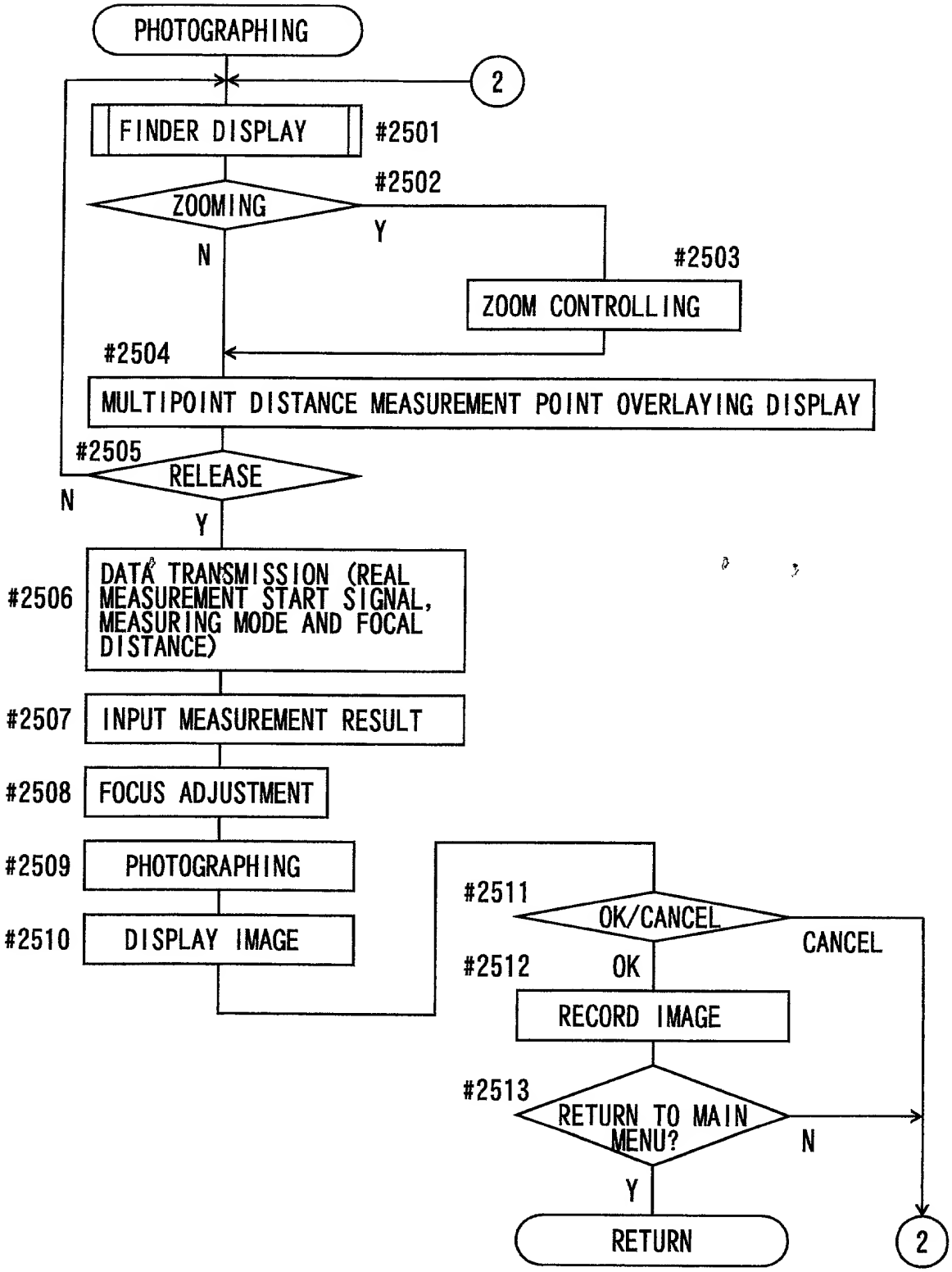
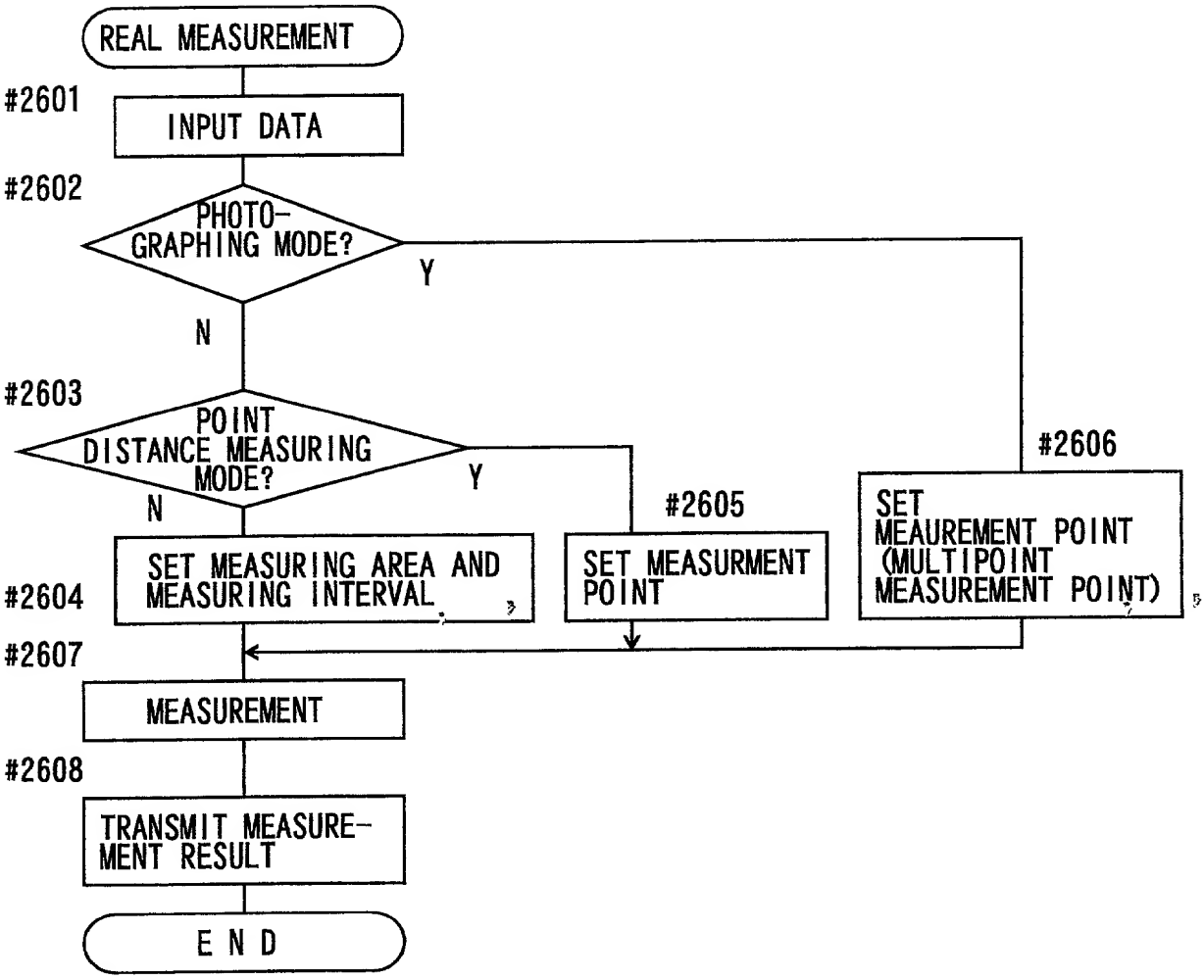

PHOTOGRAPHING
2
FINDER DISPLAY
#2501
#2502
ZOOMING
Y
N
#2503
ZOOM CONTROLLING
#2504
MULTIPOINT DISTANCE MEASUREMENT POINT OVERLAYING DISPLAY
#2505
RELEASE
N
Y
#2506
DATA TRANSMISSION (REAL MEASUREMENT START SIGNAL, MEASURING MODE AND FOCAL DISTANCE)
#2507
INPUT MEASUREMENT RESULT
#2508
FOCUS ADJUSTMENT
#2509
PHOTOGRAPHING
#2510
DISPLAY IMAGE
#2511
OK/CANCEL
CANCEL
#2512
OK
RECORD IMAGE
#2513
RETURN TO MAIN MENU?
N
Y
RETURN
2

FIG. 43


REAL MEASUREMENT
#2601
INPUT DATA
#2602
PHOTO-GRAPHING MODE?
Y
N
#2603
POINT DISTANCE MEASURING MODE?
Y
N
#2606
SET MEAUREMENT POINT (MULTIPOINT MEASUREMENT POINT)
#2605
SET MEASURMENT POINT
#2604
SET MEASURING AREA AND MEASURING INTERVAL
#2607
MEASUREMENT
#2608
TRANSMIT MEASURE-MENT RESULT
E N D